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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/773,821	02/05/2004	Bart van Schravendijk	NOVLP037C1/NVLS-000519C1	8057

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EXAMINER	
DOLAN, JENNIFER M	

ART UNIT	PAPER NUMBER
2813	

DATE MAILED: 02/16/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/773,821	SCHRAVENDIJK ET AL.	
	Examiner	Art Unit	
	Jennifer M. Dolan	2813	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-9* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-9* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *05 February 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *2/5/04*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Double Patenting

1. A rejection based on double patenting of the "same invention" type finds its support in the language of 35 U.S.C. 101 which states that "whoever invents or discovers any new and useful process ... may obtain a patent therefor ..." (Emphasis added). Thus, the term "same invention," in this context, means an invention drawn to identical subject matter. See *Miller v. Eagle Mfg. Co.*, 151 U.S. 186 (1894); *In re Ockert*, 245 F.2d 467, 114 USPQ 330 (CCPA 1957); and *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970).

A statutory type (35 U.S.C. 101) double patenting rejection can be overcome by canceling or amending the conflicting claims so they are no longer coextensive in scope. The filing of a terminal disclaimer cannot overcome a double patenting rejection based upon 35 U.S.C. 101.

2. Claim 9 is rejected under 35 U.S.C. 101 as claiming the same invention as that of claim18 of prior U.S. Patent No. 6,720,251. This is a double patenting rejection.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 1-4 and 6-8 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,635,583 to Bencher et al. in view of U.S. Patent No. 6,316,167 to Angelopoulos et al (cited by applicant).

Regarding claims 1, 6, and 8, Bencher discloses a method of fabricating an anti-reflective layer (15; figures 1-4) of a dual damascene device (figure 4) in a chemical vapor deposition chamber (column 9, line 60 – column 10, line 20), comprising the steps of: forming a low-k

dielectric layer (14, 18; column 2, lines 42-48) on a semiconductor substrate (12) that is to be patterned; forming an anti-reflective layer (15) over the first layer (figures 1-4), wherein the antireflective layer comprises substantially no nitrogen (SiC contains substantially no nitrogen), depositing and patterning a photoresist layer (19) that contacts the antireflective layer (figures 1-4), thereby patterning the low-k dielectric layer to form interconnect line regions (figures 1-4); and forming a conductive layer (20) in the interconnect line regions.

Bencher fails to disclose that the antireflective layer comprises about 20-80% oxygen, such that the extinction coefficient is between about 0 and 1.3 at 248 nm.

Angelopoulos discloses an antireflective layer formed of oxygenated SiC, where the oxygen composition intersects the claimed range (see column 8, lines 10-25), thus forming a film having an extinction coefficient between 0 and 1.3 at 248 nm (see column 10, lines 20-35).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the antireflective layer of Bencher, such that it comprises 20-80% oxygen, as suggested by Angelopoulos. The rationale is as follows: A person having ordinary skill in the art would have been motivated to provide 20-80% oxygen to the SiC antireflective layer of Bencher, because Bencher teaches that the fundamental desired properties for an antireflective layer include a low dielectric constant, minimization of undesired reflections, high etch selectivity with respect to typical low-k or damascene materials, and simple manufacturability (see Bencher, column 7, lines 20-45), and Angelopoulos teaches that an oxygenated SiC antireflective film has the above-mentioned properties (see Angelopoulos, column 7, lines 45-60; column 8, lines 25-55), as well as the advantage of not reacting with the photoresist (see Angelopoulos, column 7, lines 45-50). Furthermore, since Angelopoulos shows that both SiC

and SiCO films can be equivalently and interchangeably used (Angelopoulos, column 8, line 55-column 10, line 35), such that the oxygen content of the film is merely used to tune the index of refraction and extinction coefficient, it is well within the purview of a person skilled in the art to add oxygen to the antireflective layer of Bencher, in order to achieve this degree of tunability.

Regarding claims 2, 3, and 7, Bencher fails to specify the methodology of forming a SiCO-based film.

Angelopoulos discloses forming the SiCO-based film using gas or liquid sources of carbon, hydrogen, silicon, and oxygen (column 5, lines 35-42; column 9, lines 1-60; a methylsilane is a source of carbon, hydrogen, and silicon), where the oxygen source is elemental oxygen (column 8, lines 38-40; column 9, lines 10-15), and where the ARL is formed in a high density plasma CVD reactor (column 9, line 65-column 10, line 3).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to specify that the ARL in the method of Bencher as modified by Angelopoulos, supra, uses the deposition methodology taught by Angelopoulos. The rationale is as follows: A person having ordinary skill in the art would have been motivated to use high density plasma CVD and the specified source gases, because the Angelopoulos reference is the one that teaches formation of the oxygenated SiC film, and thus it would be apparent to use the specific methodology taught in Angelopoulos for the formation of the oxygenated SiC film.

Regarding claim 4, both Bencher and Angelopoulos disclose the use of silane as a precursor for forming the ARL (Bencher, column 8, lines 50-67 ; Angelopoulos, column 9, lines 1-60).

There is no teaching, however, as to the exact flow rates per square centimeter of the precursor.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to specify a silane flow rate of 0.01-0.5 sccm per square centimeter in the ARL method forming step of Bencher as modified by Angelopoulos. The rationale is as follows: A person having ordinary skill in the art would have been motivated to specify such a flow rate, because the selection of specific precursors and gas flows allows for the tunability of optical properties of the anti-reflective film, such as extinction coefficient and index of refraction (Angelopoulos, column 10, lines 5-11). Although Angelopoulos fails to specify flow rates for the gases, it has been held that "where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation." *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (1955) (Also see Angelopoulos, column 10, lines 11-44).

5. Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Bencher et al. in view of Angelopoulos et al., as applied to claim 2, supra, and further in view of U.S. Patent No. 6,147,009 to Grill et al.

Bencher is silent as to applying radio frequency power in the CVD chamber.

Grill discloses applying radio frequency power in the chemical vapor deposition chamber (column 5, lines 18 – 55). Grill further discloses RF power intensities from 7 – 25W (column 5, lines 47 – 67), but fails to disclose the surface area of the anti-reflective layer.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the method of Bencher as modified by Angelopoulos, such that radio frequency power is applied in the chemical vapor deposition chamber, as taught by Grill, and such that the power intensity is from 0.05W – 5.5W per square centimeter of the surface of the anti-reflective layer. The rationale is as follows: One of ordinary skill in the art at the time the invention was made would have been motivated to select an RF power supply and the claimed power intensity ranges, because doing so aids in the deposition and optical property tuning of the SiCOH films (Grill, column 5, line 46 – column 6, line 24). Angelopoulos likewise teaches that the alteration of process parameters allows for the optimization of the extinction coefficient and index of refraction (Angelopoulos, column 10, lines 4 – 12). Although Bencher, Angelopoulos, and Grill do not specify power intensities per square centimeter of the coating, it has been held that "where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation." *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (1955) (Also see Angelopoulos, column 10, lines 11-44).

Conclusion

6. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

U.S. Patent No. 6,376,392 to Lee et al. discloses silicon oxycarbide ARLs

U.S. Patent Publication No. 2002/0155386 to Xu et al. discloses SiCOH layers applied to a dual damascene structure.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jennifer M. Dolan whose telephone number is (571) 272-1690. The examiner can normally be reached on Monday-Friday 8:30am-5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl W. Whitehead, Jr. can be reached on (571) 272-1702. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Jennifer M. Dolan
Examiner
Art Unit 2813

jmd

Craig A. Thompson

CRAIG A. THOMPSON
PRIMARY EXAMINER